

Running Head: Impact of Distractive Auditory Stimuli on Health-Related Quality of Life

The Impact of Distractive Auditory Stimuli on Indicators of Health-Related Quality of Life in

Patients with COPD

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## **I. Introduction**

Chronic Obstructive Pulmonary Disease, abbreviated as COPD, is an umbrella term consisting of two diseases: chronic bronchitis and emphysema. These diseases are caused by obstruction to airflow (American Lung Association, 2006). According to the American Lung Association in 2006, COPD is the fourth leading cause of mortality in the United States. Smoking is estimated to be the cause in 80-90 percent of these cases. It was estimated that 11.4 million American adults in 2004 had COPD, costing the U.S. more than \$37 billion in healthcare costs (American Lung Association, 2006).

Pulmonary rehabilitation (PR) is an important aspect of the lifelong management of COPD. According to the research article by Paz-Diaz and colleagues, PR helps to improve physical activity tolerance and trains the patient to gain control of and possibly reduce symptoms related to the disease. This increased physical activity tolerance leads to an ability to function more efficiently and independently (Paz-Diaz, Montes de Oca, Lopez, & Celli, 2007).

A common goal in clinical guidelines dealing with the management of COPD is to improve the patient's quality of life (Niesink, Trappenburg, de Weert-van Oene, Lammers, Verheij, & Schrijvers, 2007). A limitation in functional abilities and independence caused largely by the constant feeling of dyspnea worsens the feelings of anxiety and depression commonly experienced by these patients (Paz-Diaz et al, 2007). Such symptoms would undoubtedly impact a person's quality of life. Therefore using PR to help improve the patient's functional ability could lead to an increase in independence and pride in their accomplishments, thus improving the patient's feelings of self-worth and their perception of their quality of life.

Many different PR programs have been implemented using various methods of exercise, counseling, and patient education. The specific types of interventions used in the PR program

can be important in shaping the overall effect the treatment regime will have on the individual. Evidence-based clinical guidelines have been established and revised throughout the years for PR. (Ries, Bauldoff, Casaburi, Mahler, Rochester, and Herrerias, 2007) It is necessary to examine whether there is a specific link between the types of interventions used in a PR program and the improvement in the individual's stated quality of life. While a significant amount of research reports correlations of PR to improved quality of life, no studies were identified that found specific interventions used during PR play a direct role in the patient's perception of their quality of life.

Distractive auditory stimuli, most often expressed as listening to music during a stressful or strenuous experience, is one intervention that has been studied in patients with COPD during pulmonary rehabilitation. Data has been collected through research to link the use of DAS to benefits in this population (Thornby, Haas, & Axen, 1995). Articles have found that distractive auditory stimuli has helped with dyspnea and the perceived intolerance of exercise in the COPD population (von Leupoldt, Taube, Schubert-Heukeshoven, Magnussen, & Dahme, 2007). While it can be likely hypothesized that a decreased feeling of dyspnea and better tolerance for exercise may help improve an individual's quality of life, this has not been found to be explicitly researched (excluding the primary study for this secondary analysis). The primary study did not find a significant difference in health-related quality of life with the implementation of DAS.

Therefore, using the theoretical framework of *The Theory of Unpleasant Symptoms* (Lenz, Pugh, Milligan, Gift, & Suppe, 1997), the following section will examine whether a specific intervention, distractive auditory stimuli while exercising, has an effect on specific health related quality of life indicators.

## **II. Literature Review**

The positive effects of pulmonary rehabilitation on the physical and psychological state of an individual with COPD have been adequately studied and there is strong evidence to prove PR as effective in COPD management (Ries et al., 2007). However no data was found on the effect of different additional interventions implemented along with the pulmonary rehabilitation and whether these supplementary interventions had different effects on the patient's stated quality of life. Of importance to this study is the addition of distractive auditory stimuli to the individual's workout as part of PR therapy. While distractive auditory stimuli has been studied in the COPD population during pulmonary rehabilitation, there were no studies found on its significant direct effect on individual's stated health-related quality of life.

### *COPD*

COPD is a prevalent disease in the United States with an estimated 11.4 million adults living with the disease in 2004 (American Lung Association, 2006). According to the American Lung Association, the disease also now claims more women's than men's lives and has smoking as its primary cause, accounting for 80-90% of all COPD-related deaths (American Lung Association, 2006). The disease brings with it a tremendous amount of physical and psychological stress and exertion. The physical limitations of living and working often brought on by COPD exhausts the individual mentally and emotionally. Common symptoms experienced with COPD include anxiety, depression, dyspnea, and decreases in level of physical functioning ability (Paz Diaz et al., 2007). These limitations affect the individual's ability to carry out activities of daily living, thus possibly lowering self-esteem and perceived quality of life.

### *Pulmonary Rehabilitation*

Pulmonary rehabilitation has been proven through extensive research to be beneficial to those with COPD (Ries et al., 2007). All research articles found included some form of exercise regime as part of the rehabilitation and many advocated for the pulmonary rehabilitation to be approached as a multidisciplinary process. The interdisciplinary team can include any of the following: physicians, physiotherapists, nurses with specialized respiratory training, dieticians, social workers, and healthcare providers to educate about smoking cessation. Along with the exercise aspect of rehabilitation, a diverse healthcare team can provide information about diet and nutrition, education on multiple aspects of the disease and its course, and psychological and social support to assist in a successful experience (Ries et al., 2007). PR should also aim to have the participants achieve self-responsibility for the management of their disease, including committing long-term to exercises taught during rehabilitation (Fenton, 2007).

Effective PR programs can be set up in a variety of setting with minimal resources to reach a broader population. Such low-maintenance programs can keep healthcare costs down for the individual and also for the nation. Even shorter durations of PR (i.e. 10 days) have been effective in reducing dyspnea, increasing activity tolerance, and improving HRQoL. PR programs vary from inpatient to outpatient and range in duration from 10 days to 18 months. When taking into account healthcare dollars spent on treatment of uncontrolled COPD symptoms and subsequent hospitalizations, PR has been determined to be cost-effective in COPD patients (Ries et al., 2007).

The main goals of pulmonary rehabilitation are not directed towards actual improvements in lung functioning and improvements do not have to take place to make the rehabilitation

successful. It is a common assumption that PR cannot improve pulmonary functioning; however, this is unclear, especially related to the duration of benefits following PR (Ries et al., 2007).

Nishiyama and colleagues (2005) studied implications regarding the individual long-term effectiveness of PR by evaluating the relationships between lung function, 6 minute walk distances (measuring exercise tolerance), and feelings of dyspnea to maintenance of PR benefits and HRQoL. The sample included 53 participants who were followed for one year after completion of PR. Unfortunately all improvements noted in pulmonary functioning, level of dyspnea, and rating for quality of life after the program had not remained elevated significantly above pre-rehabilitation levels (Nishiyama, Taniguchi, Kondoh, Kimura, Ogawa, Watanabe, and Arizono, 2005). Since pulmonary rehabilitation has been found to be successful in improving quality of life, it is troublesome to see this value deteriorate with increased time since healthcare intervention. As a result it becomes increasingly important to determine the individual effect of specific PR interventions on quality of life. Specific interventions, such as DAS, may also improve sustained benefits of PR by making it more enjoyable for patients to continue their own exercise programs once PR programs are completed.

#### *Health-Related Quality of Life/ St. George Respiratory Questionnaire*

The perception by an individual with COPD of their quality of life from living with their disease is important to measure as it is usually the final outcome of the interplay between all the signs and symptoms experienced as a result of the condition. The effects of the disease make it difficult to cope physically, mentally, and socially with the daily stresses they add to the patient's life (American Lung Association, 2006). Inability to handle stressors can decrease the quality of the individual's daily life.

There are multiple instruments that have been used to measure health-related quality of life; this particular study used the original St. George Respiratory Questionnaire (SGRQ) to obtain an objective measurement of the patient's stated health-related quality of life (HRQoL). The original SGRQ has been in circulation for 17 years and consists of 50 items covering three concepts: symptoms, activity (physical functioning ability), and impacts (effect on daily life). The symptom subscore requires participants to recall severity of symptoms at different time frames. Each section is given a subscore and these scores are added to give the researcher a total score. The total score can range from 0 to 100, with higher scores indicating poorer health and quality of life (Jones, Quirck, Baveystock, & Littlejons, 1992). Merguro and colleagues developed an updated version of the questionnaire in 2007. The updated questionnaire retains only the items they found to be easily answered, effectively and correctly measured, and pertinent to the COPD disease itself (Merguro, Barley, Spencer, and Jones, 2007).

### *Distractive Auditory Stimuli*

The concept of distractive auditory stimuli (DAS) is rooted in the idea of attentional distraction. Attentional distraction refers to the ability of an individual to focus their attention on a different stimulus (von Leupoldt et. al, 2007). The concept is to distract the individual from dyspnea by blocking their pre-conscious perception of dyspnea. Distraction in the studies of COPD patients undergoing pulmonary rehabilitation has been an auditory stimulus, implemented by the patients listening to music while exercising. In focusing on stimuli such as music the patient is more apt to turn attention away from the other stimuli occurring, such as negative sensations and emotions (von Leupoldt et. al, 2007). If attention can be directed away from these experiences, the awareness and/or fear of them can be decreased.



The study by Thornby, Haas, and Axen found that participants listening to music while exercising described the exercise session as less tiring, reached higher maximum heart rates, walked longer, and worked harder (performed more work) than the control groups who listened to either grey noise or silence. The ability to exercise longer and harder can lead to improved physical outcomes, while enjoyment and decreased negative feelings associated with exercising can help with long-term maintenance of rehabilitation. Increases in physical ability and functioning can lead to independence and an improved quality of life. Therefore it is important to analyze whether the use of DAS has direct effects on the individual's perceived quality of life (Thornby, Haas, and Axen, 1995).

### *Theory of Unpleasant Symptoms*

The *Theory of Unpleasant Symptoms* is used as the theoretical framework on which this research is based. This theory ascertains that multiple factors may influence how a number of different symptoms are experienced or perceived. Three aspects of the theory include: the symptom being experienced, the surrounding factors leading to or affecting the experience, and the outcome or consequences of the symptom. The influencing factors can be categorized as physiologic, psychologic, or situational factors. While these factors can have an influencing effect on the symptoms and the individual's experience, symptoms can likewise have an effect on an individual's physiologic, psychologic, or situational condition. An example given in the literature illustrates the fact that chronic pain can ultimately affect an individual's moods (Lenz et. al, 1997).

The theory also recognizes the fact that individuals often experience multiple unpleasant symptoms at the same time; an example from the literature includes pain and nausea being

experienced simultaneously. The framework theorizes that experiencing multiple symptoms can affect the experiences of each symptom and compound their overall effect on the individual. The theory also recognizes that the same factors may influence several symptoms being experienced by the individual. Another example from the literature illustrates how past experiences with a physical illness can affect an individual's tolerance to both pain and anxiety. Therefore, insight into which factors influence the symptom can lead to more effective and efficient interventions. Interventions, according to this theory, should be focused on altering the factors leading to multiple symptoms, as opposed to targeting the symptoms themselves. Interventions will be more efficient in having positive results on more than one unpleasant experience (Lenz et. al, 1997).

This theory supports this research by illustrating the concept that the experience of different unpleasant COPD symptoms can impact an individual's overall quality of life.

### III. Methods

This research study is a secondary analysis of a previous study by Dr. Gerene Bauldoff published in 2002 entitled “*Exercise Maintenance Following Pulmonary Rehabilitation*”.

The primary study was a randomized experimental study consisting of 24 participants categorized with moderate to severe COPD. Various data was collected at baseline (beginning on PR program), 4 weeks and 8 weeks following baseline collection. The study’s participants were randomly distributed into the control or the experimental group. The experimental group utilized the DAS intervention by listening to music during PR exercise that each participant selected from a list of choices (country/western, big band, classical, or pop/Motown). The control group did not listen to any intentional auditory stimulus while exercising, including music. The exercise periods were unsupervised sessions throughout the individual’s week that participants recorded in their exercise logs (Bauldoff, Hoffman, Zullo and Sciurba, 2002). Funding for the primary study was from the National Institute of Nursing Research, National Institutes of Health.

The St. George Respiratory Questionnaire (SGRQ) was used in the primary study to obtain data about health-related quality of life. The SGRQ is a valid instrument to use in the COPD population and obtains a measurable score for an individual’s HRQoL. The SGRQ has been in circulation for over 17 years. The instrument is a self-reporting tool that helps gain insight into how living with COPD affects an individual’s life. It consists of 50 items divided up into three realms: symptoms, activity, and impacts. Specific individual questions were used as the indicators of HRQoL in this study (Jones, et al., 1992). The *symptoms* section is focused on the physical signs and symptoms of the disease (such as cough, sputum production, and dyspnea) throughout daily life. The *activity limitations* section is concerned with how the disease impacts and interferes with the accomplishment of activity of daily living (ADL’s). Lastly the *disease*

*impacts* section relates to the management of COPD with the fulfillment of life's events; for example how the treatment and management of COPD (i.e. medications) relates to their employment, self-esteem, and recreational activities. This instrument obtains scores for each of the three realms individually and also a total score for an overall value. This helps because it is able to give insight into which specific components are problematic. The instrument is scored with higher scores indicating a poorer HRQoL (Jones, et al., 1992).

The specific research question of this study is the following: Does DAS during PR exercise positively impact indicators of HRQoL related to the COPD condition? The researchers involved in this study hypothesized that the DAS group would improve in the specific HRQoL indicators chosen significantly more than the control group post-rehabilitation.

For the purpose of this study, indicators of HRQoL are defined as the individual questions answered by the participants on the SGRQ. Eighteen questions were chosen from the SGRQ to be HRQoL indicators based on the ability to format the answers into dichotomous variables. Answers to the questions chosen were either a 1 (indicating the symptom was present and the statement was true for the individual) or 2 (indicating the symptom was absent and the statement was false for the individual). Pertinent raw data from the primary study was entered into the latest version of the computer program SPSS. Variables used included participant number, demographic data, specific SGRQ answers as HRQoL indicators, and participation group (control vs. DAS). Change scores were calculated for each indicator score between data collected at baseline and at eight weeks post PR initiation for all participants.

Change scores were coded based on change in answers, as described previously, regarding symptomatology from baseline to 8-weeks. Codes were as follows: 1 indicated a change from 2-1; 2 indicated a change from 1-1; 3 indicated a change from 2-2; and 4 indicated a

change from 1-2. A change score code was placed as a variable in the SPSS data set for each participant and question. Kendall's Tau-b test in crosstabs was used to analyze the data and determine the presence of significant findings between both the DAS and control groups.

Significance was determined by  $p$  value less than or equal to 0.05.

Code for variable change score	Determined by SGRQ answers to indicator questions: Baseline – 8 weeks
1	2-1
2	1-1
3	2-2
4	1-2

After determining significance of indicator's change scores, the direction of significant change had to be verified. The researchers termed this the change outcome for each significant HRQoL indicator change score. A negative change outcome was defined by a change score of 1 (answers from 2 at baseline to 1 at 8-weeks). A neutral change outcome was defined by a change score of 2 (answers from 1 to 1) and a change score of 3 (answers from 2 to 2). Lastly, a positive change outcome (or best case scenario) was defined as a change score of 4 (answers from 1-2). For each significant finding, the number of participants that fell into each change outcome category was listed out for the DAS group and the control group. The resulting chart (displayed in the results section) was used to determine the overall change outcome for each significant HRQoL indicator.

#### IV. Results

Analysis of HRQoL indicator baseline data confirms that there were no significant differences in the data between the two groups at baseline. This is important to establish equality and comparability between the two groups' compositions.

Significant differences were found for two of the HRQoL indicators and one trended towards significance. However, this left 15 indicators not found to have a significant difference from baseline to 8-weeks. Results were analyzing a change in answers to symptomatology questions from baseline to 8-weeks and the direction (improvement or deterioration) to which these answers changed in both the DAS and control groups.

One of the significant differences involved the HRQoL indicator inquiring about feelings of panic when experiencing shortness of breath and had a  $p$  value of .043. The other significant finding involved the HRQoL indicator inquiring about feelings of shortness of breath while talking and had a  $p$  value of .013. The HRQoL indicator that trended towards significance asked about feelings of shortness of breath when bending over and was found to have a  $p$  value of .081. The 15 remaining indicators had no significant results after analysis was performed.

Change outcomes were analyzed to see if significant findings were indicative of an improvement or deterioration of the DAS group's symptoms post-rehabilitation compared to the control group's symptoms.

To determine which direction each HRQoL indicator's change outcome leaned towards as representative of each group as a whole, each group was analyzed to see how many participants fell into each category: positive, neutral, and negative change outcomes.

## Panic With Dyspnea

	Positive	Neutral	Negative
Music	1	10	1
Control	3	9	0

## Dyspnea While Talking

	Positive	Neutral	Negative
Music	0	8	4
Control	0	12	0

## Dyspnea While Bending Over

	Positive	Neutral	Negative
Music	2	9	1
Control	7	5	0

The HRQoL indicator of panic with shortness of breath and the HRQoL indicator of shortness of breath while talking were both found to have negative change outcomes for the DAS group but not for the control group. A negative change outcome is found by having the number of participants stating having symptoms being absent at baseline to symptoms being present at 8 weeks following PR initiation being greater than or equal to the number of participants stating the opposite (symptoms from present to absent). These findings imply that the DAS group experienced a worsening of these symptoms from baseline to post-rehabilitation, while the control group did not experience such changes.

These findings argue against the hypothesis of this study. One key limitation that may have affected these results included the primary study being determined to be underpowered for analysis of health-related quality of life data.

## **V. Discussion**

One major limitation included the primary study being determined to be underpowered for the analysis of health-related quality of life data. This could have an important effect on both the amount of indicators with change scores found to be significant and the direction of the change outcomes for those findings found to be significant. This is a limitation to the study being a secondary analysis due to the inability to decide the number of participants needed for the particular data that the researchers desired to analyze. Also worth noting is the exercise sessions the DAS was used during were unsupervised. Although the DAS group did verbalize back instructions on using music while exercising, the lack of supervision by nature will lead to an uncertainty about how often the intervention was used by the DAS group.

The primary finding of the results found is the DAS group only had a significant change in indicator answers for 2 out of 15 total indicators analyzed and these significant changes were the result of a worsening of symptoms. The negative change outcome found for both significant findings tells us that as a whole the DAS group worsened following PR in the 2 indicators found to be significant. This implication argues directly against the original hypothesis of this study. Unfortunately, it is difficult to determine whether this finding is truly indicative of the course of the participant's symptomatology throughout rehabilitation or if it is due to the limitations mentioned previously.

One recommendation from this study would to implement a primary study in a larger sample with the same research question of this secondary analysis. This would provide sufficient power to accurately analyze health-related quality of life. Another suggestion would be to implement the DAS intervention directly into a supervised aspect of PR to assure greater research control to the study.



## **VI. Conclusion**

COPD is a prominent and costly disease in the United States. Symptomatology of the disease greatly limits the individual's lung capacity and in turn inhibits functional capabilities, leading to a tremendous impact on the person's quality of life (American Lung Association, 2006). Research into interventions that are able to effectively manage or improve symptomatology can greatly impact the health-related quality of life for those with COPD.

DAS would be a simple, cost-efficient intervention to add to the established standard of PR for disease management (Ries et al., 2007). While this study was not able to establish DAS as an effective intervention at reducing HRQoL related to symptomatology, previous research studies have established DAS as successful at improving exercise sessions in COPD patients (von Leupoldt et. al, 2007). Ability to work harder and longer can be indicative of a decrease in severity of symptoms related to COPD. A decrease of negative symptoms and feelings (i.e. anxiety and depression) may be able to improve the individual's overall outlook and experience of life. Therefore more research into the direct effect of DAS on HRQoL should be considered to improve the life of those with COPD.

While this study aimed at establishing the use of DAS as effective at improving HRQoL in order to justify it as an addition to PR, implementation into PR may be more effective at establishing any success in DAS. Implementation into PR would establish the supervision and control over DAS use that could possibly have an effect on additional findings.

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